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Fully Automatic Vehicle for Multipurpose Applications

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***Abstract*— This fully automatic vehicle is equipped by micro controller, motor driving mechanism and battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller.This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.**

***Index Terms*— Full automation, semi automation, Lead-acid battery**

I. Introduction

Degrees of automation are of two types, viz.

- Full automation.
- Semi automation.

In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible. Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low cost automation. The main advantages of all pneumatic systems are economy and simplicity. Automation plays an important role in mass production. For mass production of the product, the machining operations decide the sequence of machining. The machines designed for producing a particular product are called transfer machines. The components must be moved automatically from the bins to various machines sequentially and the final component can be placed separately for packaging. Materials can also be repeatedly transferred from the moving conveyors to the work place and vice versa.

Nowadays almost all the manufacturing process is being atomized in order to deliver the products at a faster rate. The manufacturing operation is being atomized for the following reasons.

- To achieve mass production
- To reduce man power
- To increase the efficiency of the plant
- To reduce the work load
- To reduce the production cost
- To reduce the production time
- To reduce the material handling
- To reduce the fatigue of workers
- To achieve good product quality
- Less Maintenance

Inside a lead-acid battery, the positive and negative electrodes consist of a group of plates welded to a connecting strap. The plates are immersed in the electrolyte, consisting of 8 parts of water to 3 parts of concentrated sulfuric acid. Each plate is a grid or framework, made of a lead-antimony alloy. This construction enables the active material, which is lead oxide, to be pasted into the grid. In manufacture of the cell, a forming charge produces the positive and negative electrodes. In the forming process, the active material in the positive plate is changed to lead peroxide (pbo_2). The negative electrode is spongy lead (pb).

Automobile batteries are usually shipped dry from the manufacturer. The electrolyte is put in at the time of installation, and then the battery is charged to from the plates. With maintenance-free batteries, little or no water need be added in normal service. Some types are sealed, except for a pressure vent, without provision for adding water.

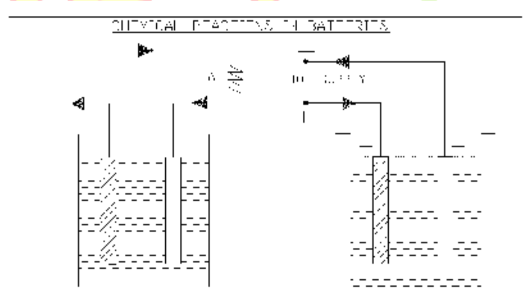

Fig.1. Chemical reaction in batteries

At the same time, charging enables the lead sulfate on the negative plate to react with hydrogen ions; this also forms sulfuric acid while reforming lead on the negative plate to react with hydrogen ions; this also forms currents can restore the cell to full output, with lead peroxide on the positive plates, spongy lead on the negative plate, and the required concentration of sulfuric acid in the electrolyte.

On discharge, the pb and pbo₂ combine with the SO_4 ions at the left side of the equation to form lead sulfate ($pbSO_4$) and water (H_2O).

One battery consists of 6 cells, each have an output voltage of 2.1V, which are connected in series to get a voltage of 12V and the same 12V battery is connected in series, to get a 24 V battery. They are placed in the water proof iron casing box.

Always extreme caution should be taken when handling batteries and electrolyte. Wear gloves, goggles and old clothes. "Battery acid" will burn skin and eyes and destroy cotton and wool clothing. The quickest way of ruin lead-acid batteries is to discharge them deeply and leave them stand "dead" for an extended period of time. When they discharge, there is a chemical change in the positive plates of the battery. They change from lead oxide when charge out lead sulfate when discharged. If they remain in the lead Sulfate State for a few days, some part of the plate dose not returns to lead oxide when the battery is recharged. If the battery remains discharge longer, a greater amount of the positive plate will remain lead sulfate. The parts of the plates that become "sulfate" no longer store energy. Batteries that are deeply discharged, and then charged partially on a regular basis can fail in less then one year.

Check your batteries on a regular basis to be sure they are getting charged. Use a hydrometer to check the specific gravity of your lead acid batteries. If batteries are cycled very deeply and then recharged quickly, the specific gravity reading will be lower than it should because the electrolyte at the top of the battery may not have mixed with the "charged" electrolyte. Check the electrolyte level in the wet-cell batteries at the least four times a year and top each cell of with distilled water. Do not add water to discharged batteries. Electrolyte is absorbed when batteries are much discharged. If you add water at this time, and then recharge the battery, electrolyte will overflow and make a mess.

Keep the top of your batteries clean and check that cables are tight. Do not tighten or remove cables while charging or discharging. Any spark around batteries can cause a hydrogen explosion inside, and ruin one of the cells, and you. On charge, with reverse current through the electrolyte, the chemical action is reversed. Then the pb ions from the lead sulfate on the right side of the equation re-form the lead and lead peroxide electrodes. Also the SO_4 ions combine with H_2 ions from the water to produce more sulfuric acid at the left side of the equation.

Lead-acid batteries are generally rated in terms of how much discharge currents they can supply for a specified period of time; the output voltage must be maintained above a minimum level, which is 1.5 to 1.8V per cell. A common rating is ampere-hours (A.h.) based on a specific discharge time, which is often 8h. Typical values for automobile batteries are 100 to 300 A.h. As an example, a 200 A.h battery can supply a load current of 200/8 or 25A, used on 8h discharge. The battery can supply less current for a longer time or more current for a shorter time. Automobile batteries may be rated for "cold cranking power", which is related to the job of starting the engine. A typical rating is 450A for 30s at a temperature of 0 degree F.

Note that the ampere-hour unit specifies coulombs of charge. For instance, 200 A.h. corresponds to 200A*3600s (1h=3600s). The equals 720,000 A.S, or coulombs. One ampere-second is equal to one coulomb. Then the charge equals 720,000 or 7.2*10^5ºC. To put this much charge back into the battery would require 20 hours with a charging current of 10A.

The ratings for lead-acid batteries are given for a temperature range of 77 to 80ºF. Higher temperature increase the chemical reaction, but operation above 110ºF shortens the battery life. Low temperatures reduce the current capacity and voltage output. The ampere-hour capacity is reduced approximately 0.75% for each decreases of 1º F below normal temperature rating. At 0ºF the available output is only 60 % of the ampere-hour battery rating. In cold weather, therefore, it is very important to have an automobile battery unto full charge. In addition, the electrolyte freezes more easily when diluted by water in the discharged condition.

Measuring the specific gravity of the electrolyte generally checks the state of discharge for a lead-acid cell. Specific gravity is a ratio comparing the weight of a substance with the weight of a substance with the weight of water. For instance, concentrated sulfuric acid is 1.835 times as heavy as water for the same volume. Therefore, its specific gravity equals 1.835. The specific gravity of water is 1, since it is the reference.

In a fully charged automotive cell, mixture of sulfuric acid and water results in a specific gravity of 1.280 at room temperatures of 70 to 80ºF. as the cell discharges, more water is formed, lowering the specific gravity. When it is down to about 1.150, the cell is completely discharged. Specific-gravity readings are taken with a battery hydrometer, such as one in figure (7). Note that the calibrated float with the specific gravity marks will rest higher in an electrolyte of higher specific gravity.

The decimal point is often omitted for convenience. For example, the value of 1.220 in figure (7) is simply read "twelve twenty". A hydrometer reading of 1260 to 1280 indicates full charge, approximately 12.50 are half charge, and 1150 to 1200 indicates complete discharge. The importance of the specific gravity can be seen from the fact that the open-circuit voltage of the lead-acid cell is approximately equal to

$$V = \text{Specific gravity} + 0.84 \qquad (1)$$

For the specific gravity of 1.280, the voltage is 1.280 = 0.84 = 2.12V, as an example. These values are for a fully charged battery.

Battery charging procedures:

1. The level of electrolyte is checked. If needed more electrolytes is added to maintain the level 10 mm above the top of the plate.

2. The negative and positive terminals of the battery are connected to the respective terminals of the battery charge.

3. The charging current is discharged to the current value. The current is adjusted to one ampere per positive plate.

4. Charging is connected till the formation of the gas, then the charging current is decreased and continued till there is no further increase in the specific gravity.

5. The temperature of the electrolyte should be checked to be < 45° C otherwise, during charging intermittent cooling is essential.

6. Check the battery boiling temperature to avoid overheating.

An external D.C. voltage source is necessary to produce current in one direction. Also, the charging voltage must be more than the battery e.m.f. Approximately 2.5 per cell are enough to over the cell e.m.f. so that the charging voltage can produce current opposite to the direction of discharge current.

Note that the reversal of current is obtained just by connecting the battery VB and charging source VG with + to + and –to-, as shown in figure. The charging current is reversed because the battery effectively becomes a load resistance for VG when it higher than VB. In this example, the net voltage available to produce charging currents is 15-12=3V.

A commercial charger for automobile batteries is essentially a D.C. power supply, rectifying input from the AC power line to provide D.C. output for charging batteries.

Float charging refers to a method in which the charger and the battery are always connected to each other for supplying current to the load. In figure the charger provides current for the load and the current necessary to keep the battery fully charged. The battery here is an auxiliary source for D.C. power.

It may be of interest to note that an automobile battery is in a floating-charge circuit. The battery charger is an AC generator or alternator with rectifier diodes, driver by a belt from the engine. When you start the car, the battery supplies the cranking power. Once the engine is running, the alternator charges he battery. It is not necessary for the car to be moving. A voltage regulator is used in this system to maintain the output at approximately 13 to 15 V.

The constant voltage of 24V comes from the solar panel controlled by the charge controller so for storing this energy we need a 24V battery so two 12V battery are connected in series. It is a good idea to do an equalizing charge when some cells show a variation of 0.05 specific gravity from each other. This is a long steady overcharge, bringing the battery to a gassing or bubbling state. Do not equalize sealed or gel type batteries.

With proper care, lead-acid batteries will have a long service life and work very well in almost any power system. Unfortunately, with poor treatment lead-acid battery life will be very short.

The electrical motor is an instrument, which converts electrical energy into mechanical energy. According to faraday's law of Electro magnetic induction, when a current carrying conductor is placed in a magnetic field, it experiences a mechanical force whose direction is given by Fleming's left hand rule. Constructional a dc generator and a dc motor are identical. The same dc machine can be used as a generator or as a motor. When a generator is in operation, it is driven mechanically and develops a voltage. The voltage is capable of sending current through the load resistance. While motor action a torque is developed. The torque can produce mechanical rotation. Motors are classified as series wound, shunt wound motors.

II. PRINCIPLE OF OPERATION

The motor run's according to the principle of Fleming's left hand rule. When a current carrying conductor is placed in a magnetic field is produced to move the conductor away from the magnetic field. The conductor carrying current to North and South poles is being removed. In the above stated two conditions there is no movement of the conductors. Whenever a current carrying conductor is placed in a magnetic field. The field due to the current in the conductor but opposes the main field below the conductor. As a result the flux density below the conductor. It is found that a force acts on the conductor to push the conductor downwards.

If the current in the conductor is reversed, the strengthening of the flux lines occurs below the conductor, and the conductor will be pushed upwards. As stated above the coil side A will be forced to move downwards, where as the coil side B will be forced to move upwards. The forces acting on the coil sides A and B will be the same coil magnitudes, but their directions will be opposite to one another. In DC machines coils are wound on the armature core, which is supported by the bearings, enhances rotation of the armature. The commutator periodically reverses the direction of current flow through the armature. Thus the armature rotates continuously.

Let's start by looking at the overall plan of a simple 2-pole DC electric motor. A simple motor has 6 parts, as shown in the diagram below.

- An armature or rotor
- A commutator
- Brushes
- An axle
- A field magnet
- A DC power supply of some sort

An electric motor is all about magnets and magnetism: a motor uses magnets to create motion. If you have ever played

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with magnets you know about the fundamental law of all magnets: Opposites attract and likes repel.

So if you have 2 bar magnets with their ends marked north and south, then the North end of one magnet will attract the South end of the other. On the other hand, the North end of one magnet will repel the North end of the other (and similarly south will repel south). Inside an electric motor these attracting and repelling forces create rotational motion. In the diagram above and below you can see two magnets in the motor, the armature (or rotor) is an electromagnet, while the field magnet is a permanent magnet (the field magnet could be an electromagnet as well, but in most small motors it is not to save power).

The data memory is partitioned into two areas. The first is the Special Function Registers (SFR) area, while the second is the General Purpose Registers (GPR) area. The SFRs control the operation of the device. Portions of data memory are banked. This is for both the SFR area and the GPR area. The GPR area is banked to allow greater than 116 bytes of general purpose RAM. The banked areas of the SFR are for the registers that control the peripheral functions. Banking requires the use of control bits for bank selection. These control bits are located in the STATUS Register. Figure 2-1 shows the data memory map organization. Instructions MOVWF and MOVF can move values from the W register to any location in the register file ("F"), and vice-versa.

The entire data memory can be accessed either directly using the absolute address of each register file or indirectly through the File Select Register (FSR) (Section 2.4). Indirect addressing uses the present value of the RP0 bit for access into the banked areas of data memory. Data memory is partitioned into two banks which contain the general purpose registers and the special function registers. Bank 0 is selected by clearing the RP0 bit (STATUS<5>). Setting the RP0 bit selects Bank 1. Each Bank extends up to 7Fh (128 bytes). The first twelve locations of each Bank are reserved for the Special Function Registers. The remainders are General Purpose Registers implemented as static RAM. Each General Purpose Register (GPR) is 8 bits wide and is accessed either directly or indirectly through the FSR (Section 2.4). The GPR addresses in bank 1 are mapped to addresses in bank 0. As an example, addressing location 0Ch or 8Ch will access the same GPR.

The program counter (PC) specifies the address of the instruction to fetch for xecution. The PC is 13 bits wide. The low byte is called the PCL register. This register is readable and writable. The high byte is called the PCH register. This register contains the PC<12:8> bits and is not directly readable or writable. All updates to the PCH register go through the PCLATH register.

The stack allows a combination of up to 8 program calls and interrupts to occur. he stack contains the return address from this branch in program execution. Midrange devices have an 8 level deep x 13-bit wide hardware stack. The stack space is not part of either program or data space and the stack pointer is not readable or writable. The PC is PUSHed onto the stack when a CALL instruction is executed or an interrupt causes a branch.

The stack is POPed in the event of a RETURN, RETLW or a RETFIE instruction execution. PCLATH is not modified when the stack is PUSHed or POPed. After the stack has been PUSHed eight times, the ninth push overwrites the value that was stored from the first push. The tenth push overwrites the second push (and so on).

The INDF register is not a physical register. Addressing INDF actually addresses the register whose address is contained in the FSR register (FSR is a pointer). This is indirect addressing.

- Register file 05 contains the value 10h
- Register file 06 contains the value 0Ah
- Load the value 05 into the FSR register
- A read of the INDF register will return the value of 10h
- Increment the value of the FSR register by one (FSR = 06)
- A read of the INDF register now will return the value of 0Ah.

Reading INDF itself indirectly (FSR = 0) will produce 00h. Writing to the INDF register indirectly results in a no-operation (although STATUS bits may be affected).

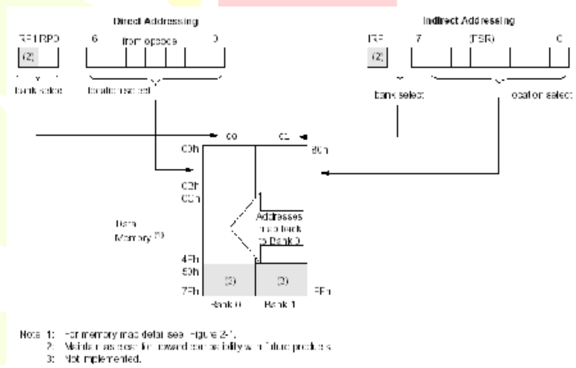

Fig.2. Direct/Indirect addressing

TABLE – I
DESIGN PARAMETERS

Components	Material	Specification
L-Angle	Mild steel C 40	20 x 15 mm
Ball Bearing	HSS	SKF 6202
Trough	Plastic	.0152 m³
Gear wheel	Cast iron	78 teeth 29 teeth(pinion)
D.C motor	………..	12 V / 2 A
Front Wheels	Nylon	Ø 100 mm
Rear Wheels	Rubber	Ø 147 mm

Area of L-angle	:	66 mm²
Total area	:	4 x 66 = 264 mm²
Total Load	:	40 Kg (Approx.)
Stress due to load	:	Load/Area = (40 x 9.81) / (264) = 1.486 N/mm² (Calculated)

Yield stress for material (C40): 323.73 N/mm² (Obtained)

Calculated stress less than obtained stress, since design is safe.

The CG of AGV lies inside the quadrilateral is formed by joining the wheel position point. Since the design is safe.

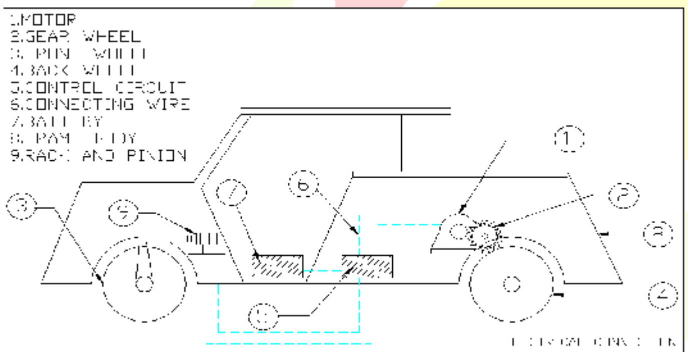

Fig.3. Fully Automated vehicle

III. Conclusion

This fully automatic vehicle is equipped by micro controller, motor driving mechanism and battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller.This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

References

[1] A.K.Sawhney. "A Text Book Of Electrical, Electronics, Instrumentation And Measurements"
[2] B.L.Therja, A.K. Theraja. "A Text Book Of Electrical Technology"
[3] G.R.Nagpal. "Power Plant Engineering" Khanna Publishers, Delhi.
[4] T.Thiyagarajan. "Fundamentals Of Electrical And Electronics Engineering" Scitech Publishers Chennai.
[5] R.S.Khurmi, J.K. Gupta "A Text Book Of Machine Desine" S.Chand & Company Ltd, Delhi.